Subject Index

A

AAT/PIG2 genes
  fungal pathogenicity and, 355
Abiotic stress
  turfgrass disease diagnosis and, 135, 139–41
Absisic acid
  leafy gall formation by *Rhodococcus fascians* and, 35
Accessory viral determinants
  plant RNA virus capsid proteins and, 430–31
ace1 gene
  predicting durability of *R* genes and, 206
Adaptation
  predicting durability of *R* genes and, 187–216
AddQ®
  biological control in greenhouse systems and, 111
Adhesins
  common mechanisms for pathogens and, 272
Aequorea victoria
  fungal pathogenicity and, 340
Aerobasidium pullulans
  fungal pathogenicity and, 356
Agrobacterium radiobacter strain K1026
  Burkholderia cepacia complex diversity and, 247–48
Agrobacterium-tagged mutagenesis
  fungal pathogenicity and, 347–48
Agrobacterium tumefaciens
  fungal pathogenicity and, 347–48, 357
  leafy gall formation by *Rhodococcus fascians* and, 28–29, 32–34, 37, 40, 42
  rhizosphere colonization by *Pseudomonas* and, 470, 472
Agrocybe spp.
  turfgrass disease diagnosis and, 142, 145
Agropyron elongatum
  predicting durability of *R* genes and, 193
Alfalfa mosaic virus
  plant RNA virus capsid proteins and, 427
  variability and genetic structure of plant virus populations, 158, 168
algW gene
  common mechanisms for pathogens and, 269
Allium spp.
  common mechanisms for pathogens and, 261
ALM gene
  fungal pathogenicity and, 346
Alternaria spp.
  Burkholderia cepacia complex diversity and, 234
  fungal pathogenicity and, 344, 346–47
  tropical plant pathology and, 7
Amaranthus caudatus
  leafy gall formation by *Rhodococcus fascians* and, 40
Ampelomyces quisqualis
  biological control in greenhouse systems and, 103, 110–11
Amplified fragment length polymorphisms (AFLPs)
  potato resistance gene organization and, 83, 86, 88
Anchor markers
  potato resistance gene organization and, 89–90
Anguina spp.
  turfgrass disease diagnosis and, 143, 147
Animals
  common mechanisms for pathogens and, 259, 262–72
  rhizosphere colonization by *Pseudomonas* and, 478–79
Anthoxanthum odoratum
  variability and genetic structure of plant virus populations, 166
Antibiotics
  Burkholderia cepacia complex diversity and, 233, 238
  common mechanisms for pathogens and, 264
  predicting durability of *R* genes and, 209, 215
  rhizosphere colonization by *Pseudomonas* and, 475
Antibodies

fungal pathogenicity and, 344–45
Antisense suppression
surface attachment and pre-penetration biology of fungi, 407
Aphanomyces spp.
Burkholderia cepacia complex diversity and, 233
polygalacturonase-inhibiting proteins and defense against fungi, 318
Aphis gossypi
variability and genetic structure of plant virus populations, 174
Apomictic polyphagous root-knot nematodes
conclusions, 68–70
crop plants as good hosts, 64
evolution, 58–60
general fitness loss, 63
host "races," 61
host range, 63–67
host status
damage, 66, 67
differences, 63–68
variation, 62–64
introduction, 54–56
Meloidogyne species, 56–57
objectives, 55–56
origins, 60–61
parthenogenesis, 57–58
Pasteuria penetrans, 62
reduced invasion, 67
resistance
overview, 64–66
resistance genes, 61
selection by resistant plants, 62–63
strong susceptible response may block resistant response, 67–68
scope, 55–56
selection, 62–63
variation, 62–63
worldwide distributions, 60–61
Applied plant pathology
turfgrass disease diagnosis and, 135, 151–52
Appressorium
surface attachment and pre-penetration biology of fungi, 385, 390–91, 393, 395, 397–407
apr genes
common mechanisms for pathogens and, 267
rhizosphere colonization by *Pseudomonas* and, 475
AQ-10®
biological control in greenhouse systems and, 111
Arabidopsis thaliana
apomictic polyphagous root-knot nematodes and, 65
common mechanisms for pathogens and, 262–63, 267–69, 272
fungal pathogenicity and, 348, 352
leafy gall formation by *Rhodococcus fascians* and, 35–36, 41
plant RNA virus capsid proteins and, 424, 429, 438–39, 444
polygalacturonase-inhibiting proteins and defense against fungi, 315
potato resistance gene organization and, 92
predicting durability of *R* genes and, 198, 203
resistance gene complexes and, 286–87, 289, 291, 297
rhizosphere colonization by *Pseudomonas* and, 470, 474
Arbuscular mycorrhizal fungi
apomictic polyphagous root-knot nematodes and, 53–55, 60, 68–69
Arthropods
plant RNA virus capsid proteins and, 430
Ascochyta pisi
polygalacturonase-inhibiting proteins and defense against fungi, 318
Ashbya gossypii
fungal pathogenicity and, 353
Aspergillus flavus
Burkholderia cepacia complex diversity and, 246–47
Aspergillus japonicum
polygalacturonase-inhibiting proteins and defense against fungi, 316
Aspergillus nidulans
fungal pathogenicity and, 347, 353
Aspergillus niger
fungal pathogenicity and, 347
polygalacturonase-inhibiting proteins and defense against fungi, 315–19
att genes
leafy gall formation by *Rhodococcus fascians* and, 36, 38–39, 40–42
Autoinduction
common mechanisms for pathogens and, 264–67
Autoregulatory compounds
leafy gall formation by *Rhodococcus fascians* and, 27
Auxins

leafy gall formation by *Rhodococcus fascians* and, 34–35, 39
avr genes
apomictic polyphagous root-knot nematodes and, 65
fungal pathogenicity and, 346, 350
plant RNA virus capsid proteins and, 437
potato resistance gene organization and, 81–82, 94
predicting durability of *R* genes and, 189, 192–207
resistance gene complexes and, 285–88, 290, 292–302, 303
Axoxystrobin
turfgrass disease diagnosis and, 144–45
Azorhizobium caulinodans
rhizosphere colonization by *Pseudomonas* and, 480
Azoxystrobin
barley yellow rust and, 377

B

Bacillus graminis
biological control in greenhouse systems and, 110
Bacillus subtilis
biological control in greenhouse systems and, 103, 107, 109–12
Bacteria
apomictic polyphagous root-knot nematodes and, 53, 55, 62
biological control in greenhouse systems and, 122
Burkholderia cepacia complex diversity and, 225, 232, 236, 242–44
common mechanisms for pathogens and, 259–75
leafy gall formation by *Rhodococcus fascians* and, 27–43
plant RNA virus capsid proteins and, 432
potato resistance gene organization and, 79, 88-89
predicting durability of *R* genes and, 189, 193–204, 214–15
rhizosphere colonization by *Pseudomonas* and, 461–80
surface attachment and pre-penetration biology of fungi, 385, 388
variability and genetic structure of plant virus populations, 160
Bacterium fascians
leafy gall formation by *Rhodococcus fascians* and, 28
Bananas
tropical plant pathology and, 5
Barley stripe virus
plant RNA virus capsid proteins and, 426
Barley yellow dwarf virus
plant RNA virus capsid proteins and, 432
variability and genetic structure of plant virus populations, 158, 165, 167–68
Barley yellow rust
in North America
chemical control, 376–78
cultural control, 375–76
discussion, 378–79
dissemination, 370–71
diversity, 371–73
epidemiology, 369–70
fungus, 369
innoculum source, 370
introduction, 368
overview, 368–69
resistance, 373–75
summary, 379–80
virulence, 371–73
Bayleton®
barley yellow rust and, 376
Baytan®
barley yellow rust and, 377
Bdelloid rotifers
parthenogenetic
apomictic polyphagous root-knot nematodes and, 53, 60–61
Beans
tropical plant pathology and, 5
Beet curly top virus
variability and genetic structure of plant virus populations, 158, 165, 169, 175
Beet yellows virus
plant RNA virus capsid proteins and, 431
Belonolaimus spp.
turfgrass disease diagnosis and, 143, 147
Bemisia tabaci
apomictic polyphagous root-knot nematodes and, 61
plant RNA virus capsid proteins and, 431
Benomyl
Burkholderia cepacia complex diversity and, 242
Benyvirus spp.
plant RNA virus capsid proteins and, 435
Biocides
Burkholderia cepacia

complex diversity and, 242–43
Biofertilizers
rhizosphere colonization by *Pseudomonas* and, 461
Biofilms
common mechanisms for pathogens and, 272
rhizosphere colonization by *Pseudomonas* and, 477–78
Biological control
Burkholderia cepacia complex diversity and, 225, 227, 232–34, 239, 242–44
greenhouse systems and, 103–25, 103
rhizosphere colonization by *Pseudomonas* and, 461, 464–65, 476–77
Biological transmission agents
plant RNA virus capsid proteins and, 419, 430–35
Bioremediation
Burkholderia cepacia complex diversity and, 225, 235
rhizosphere colonization by *Pseudomonas* and, 461
Biotechnology
plant RNA virus capsid proteins and, 419, 442–44
tropical plant pathology and, 9
turfgrass disease diagnosis and, 148–50
Biotic stress
turfgrass disease diagnosis and, 135, 139
Biotin
rhizosphere colonization by *Pseudomonas* and, 470
Biotrophic root pathogens apomictic polyphagous root-knot nematodes and, 53–70
BioYield®
biological control in greenhouse systems and, 109
Bipolaris spp.
turfgrass disease diagnosis and, 142, 145
Blackleg of stems
potato resistance gene organization and, 88
Blasticides
fungal pathogenicity and, 343
Blight
potato resistance gene organization and, 79, 88
Blumeria graminis
fungal pathogenicity and, 342
surface attachment and pre-penetration biology of fungi, 387–89, 407
Blumeria spp.
resistance gene complexes and, 287
Botrytis aclada
polygalacturonase-inhibiting proteins and defense against fungi, 317
Botrytis cinerea
biological control in greenhouse systems and, 111
Burkholderia cepacia complex diversity and, 234
fungal pathogenicity and, 344
polygalacturonase-inhibiting proteins and defense against fungi, 315–18
surface attachment and pre-penetration biology of fungi, 407
Botrytis spp.
biological control in greenhouse systems and, 103, 105
Bottlenecks
variability and genetic structure of plant virus populations, 164
Bovista spp.
turfgrass disease diagnosis and, 142, 145
Bradyrhizobium japonicum
leafy gall formation by *Rhodococcus fascians* and, 37
Brassica campestris
plant RNA virus capsid proteins and, 424
Brassica napus
predicting durability of *R* genes and, 212
rhizosphere colonization by *Pseudomonas* and, 474
Brassica spp.
resistance gene complexes and, 290
variability and genetic structure of plant virus populations, 166
Brefeldin A
surface attachment and pre-penetration biology of fungi, 387
Bremia spp.
resistance gene complexes and, 287
Bridging hosts
cereal diseases and, 17
BRM genes
fungal pathogenicity and, 346
Brome mosaic virus
plant RNA virus capsid proteins and, 424–25, 427
variability and genetic structure of plant virus

populations, 158
Bromovirus spp.
plant RNA virus capsid proteins and, 422, 424, 427, 435
Bromus spp.
cereal diseases and, 16–17
Bs genes
predicting durability of *R* genes and, 194, 209–10, 213
Buchnera spp.
plant RNA virus capsid proteins and, 432
Bunyavirus spp.
plant RNA virus capsid proteins and, 432–33
Burkholderia cepacia complex
common mechanisms for pathogens and, 260–61, 264–65, 268, 275
diversity and
biocontrol, 232–34
bioremediation agents, 235
characterization, 226–27
clinical environment, 235–38
commensals, 231–34
conclusions, 247–48
ecology, 230–38
environmental strains, 238–41
future research, 247–48
gene transfer, 241–42
genome, 227–30
human pathogenic strains, 235–41, 246–47
indigenous population size, 230–31
introduction, 226
microbial biological control microorganisms, 242–44
natural environment, 230–35
opportunistic human pathogens, 235–37, 246–47
persistence, 234
phytopathogens, 235
population dynamics, 234
registration, 245–46
regulatory issues, 242–47
rhizosphere, 231–32
seeds, 234
soilborne plant pathogens, 232–34
taxonomy, 226–27
virulence, 237–38
Bymovirus spp.
plant RNA virus capsid proteins and, 435

C

Cacao
tropical plant pathology and, 5
CAMV35s promoter
apomictic polyphagous root-knot nematodes and, 65
Candida albicans
fungal pathogenicity and, 347, 353
surface attachment and pre-penetration biology of fungi, 407
Candidate gene approach
potato resistance gene organization and, 79, 94–95
Capsicum frutescens
plant RNA virus capsid proteins and, 437
Capsid proteins (CPs)
plant RNA virus accessory viral determinants, 430–31
applications, 440–44
arthropod transmission, 430
biotechnology, 442–44
conclusions, 444–46
elicitors, 436–39
evolution, 420–22
flexuous RNA virus CPs, 421–22
function, 422–39
fungus transmission, 434–35
genome activation, 435–36
icosahedral RNA virus CPs, 421
interactions, 422
movement, 422–29
nematode transmission, 433–34
nonpersistent transmission, 430–31
persistent, circulative, nonpropagative transmission, 431–32
persistent, circulative, propagative transmission, 432–33
phylogeny, 420–22
prospects, 444–46
resistance, 440–42
rod-shaped RNA virus CPs, 421–22
semipersistent transmission, 431
sole virus-encoded determinant, 430
symptoms, 436–39
vector transmission, 430–35
Captan
Burkholderia cepacia complex diversity and, 242
Carbamates
tropical plant pathology and, 3

Carbon
leafy gall formation by *Rhodococcus fascians* and, 43
Carboxin
barley yellow rust and, 377
carI/carR genes
common mechanisms for pathogens and, 265
Carmovirus spp.
plant RNA virus capsid proteins and, 421, 424, 438
Carnation ringspot virus
plant RNA virus capsid proteins and, 424
Cassava
tropical plant pathology and, 1, 5–6
Catharanthus spp.
biological control in greenhouse systems and, 108
Cauliflower mosaic virus
plant RNA virus capsid proteins and, 431
Cell separation
fungal pathogenicity and, 354–55
Cell wall
polygalacturonase-inhibiting proteins and defense against fungi, 313–29
Cellulase genes
apomictic polyphagous root-knot nematodes and, 59
Cepabactin
Burkholderia cepacia complex diversity and, 233
Cepaciamide
Burkholderia cepacia complex diversity and, 233
Cepacidines
Burkholderia cepacia complex diversity and, 233
Cepacin
Burkholderia cepacia complex diversity and, 233
cepI/*cepR* quorum sensing system
common mechanisms for pathogens and, 264–67
Ceratocystis fimbriata
surface attachment and pre-penetration biology of fungi, 396
Cereal diseases
history of research, 13–24
Cf genes
potato resistance gene organization and, 90
predicting durability of *R* genes and, 204
resistance gene complexes and, 288–89, 292
cheA gene
rhizosphere colonization by *Pseudomonas* and, 468
Chemical controls
barley yellow rust and, 367, 376–78
cereal diseases and, 19
Chemical imbalances
turfgrass disease diagnosis and, 139–41
Chemical pesticides
biological control in greenhouse systems and, 103
Chemotaxis
rhizosphere colonization by *Pseudomonas* and, 466–68
Chenopodium amaranticolor
plant RNA virus capsid proteins and, 424
Chloropicrin
Burkholderia cepacia complex diversity and, 242
Chloroplasts
leafy gall formation by *Rhodococcus fascians* and, 30
Chlorothalonil
turfgrass disease diagnosis and, 145
Chromosomes
barley yellow rust and, 375
Burkholderia cepacia complex diversity and, 225, 229
potato resistance gene organization and, 79, 83, 86, 88–90
resistance gene complexes and, 289–91
Citrus tristeza virus
variability and genetic structure of plant virus populations, 158, 168–69, 174
Cladosporium fulvum
fungal pathogenicity and, 349
potato resistance gene organization and, 92
predicting durability of *R* genes and, 200, 204–6
resistance gene complexes and, 287–88
Claviceps fusiformis
surface attachment and pre-penetration biology of fungi, 396
Cloning
potato resistance gene organization and, 79, 91–92
Closterovirus spp.
plant RNA virus capsid proteins and, 426, 429, 431, 435
Cochliobolus carbonum
resistance gene complexes

and, 289
Cochliobolus heterostrophus
fungal pathogenicity and, 347, 349, 353
Cochliobolus spp.
resistance gene complexes and, 287
Cochliobolus trifolii
fungal pathogenicity and, 349
Coevolution
apomictic polyphagous root-knot nematodes and, 53, 65, 67
coil gene
predicting durability of *R* genes and, 199
Colletotrichum spp.
fungal pathogenicity and, 337, 341, 343–47, 349
polygalacturonase-inhibiting proteins and defense against fungi, 315–16, 318–19
surface attachment and pre-penetration biology of fungi, 387–89, 391, 398
turfgrass disease diagnosis and, 142, 145
Colonization
leafy gall formation by *Rhodococcus fascians* and, 27, 31–32, 42–43
Colony phase variation
rhizosphere colonization by *Pseudomonas* and, 473–75
colR/*colS* regulator system
rhizosphere colonization by *Pseudomonas* and, 475, 480
Commensals
Burkholderia cepacia complex diversity and, 231–34
Commercialization
biological control in greenhouse systems and, 103, 121–22
Common mechanisms for pathogens
for plants and animals
34H4 locus, 271
adhesins, 272
adhesion/surface attachment, 272
autoinducer/regulator of quorum sensing, 264–67
bacteria in plant and animal pathogenesis, 262–72
Burkholderia cepacia, 261
conclusions, 275
controllers, 268–69
degP gene, 268
dsbA gene, 268
effector class, 269–73
Erwinia spp., 261
exopolysaccharides, 273
exotoxin A, 270
flagella, 272–73
gacS-gacA two-component regulator system, 264
gram-negative pathogens affecting both plants and humans, 260–62
hrpM homologue, 271
innate defense response of plants, insects, and mammals, 274–75
introduction, 260
lipopolysaccharides, 273
LysR-like transcriptional regulator, 267
phenazines, 270
phospholipase C, 269–70
Pseudomonas aeruginosa, 261–62
RpoN sigma factor, 267
shared transcriptional regulators of regulator class in plant and animal pathogenesis, 262–68
virulence factors, 273–74
Competition
rhizosphere colonization by *Pseudomonas* and, 466–67, 475–76
Complementation
variability and genetic structure of plant virus populations, 169–70
Coniothyrium minitans
biological control in greenhouse systems and, 103, 107
Controllers
common mechanisms for pathogens and, 268–69
Conyza canadensis
apomictic polyphagous root-knot nematodes and, 66
Coprinus cinereus
fungal pathogenicity and, 347
Corynebacterium fascians
leafy gall formation by *Rhodococcus fascians* and, 28–29
Cotton leaf curl virus
variability and genetic structure of plant virus populations, 158, 167–69, 175
Cowpea chlorotic mottle virus
plant RNA virus capsid proteins and, 424–25
variability and genetic structure of plant virus populations, 158, 160, 168
Cowpea mosaic virus

plant RNA virus capsid proteins and, 442
cpkA gene
fungal pathogenicity and, 342
cpr5 gene
predicting durability of *R* genes and, 199
Crinivirus spp.
plant RNA virus capsid proteins and, 426, 435
Crotalaria spp.
apomictic polyphagous root-knot nematodes and, 66
Crown galls
leafy gall formation by *Rhodococcus fascians* and, 28
Crp gene
surface attachment and pre-penetration biology of fungi, 396
Cryphonectria parasitica
fungal pathogenicity and, 343, 351
polygalacturonase-inhibiting proteins and defense against fungi, 317
surface attachment and pre-penetration biology of fungi, 396
Cryptococcus neoformans
fungal pathogenicity and, 353
Ct-PKAC gene
fungal pathogenicity and, 343
Cucomovirus spp.
variability and genetic structure of plant virus populations, 169
Cucumber green mottle mosaic virus
plant RNA virus capsid proteins and, 423
Cucumber mosaic virus
plant RNA virus capsid proteins and, 424–25, 429–30
variability and genetic structure of plant virus populations, 158, 160, 162, 165, 168–69, 174–75
Cucumber necrosis virus
plant RNA virus capsid proteins and, 434
Cucumovirus spp.
plant RNA virus capsid proteins and, 424
Cucurbit yellow stunting disorder virus
variability and genetic structure of plant virus populations, 158, 174
CU gene
surface attachment and pre-penetration biology of fungi, 395–96
Cultural control
barley yellow rust and, 367, 375–76
Curvularia spp.
turfgrass disease diagnosis and, 142, 145
cyc genes
leafy gall formation by *Rhodococcus fascians* and, 30
Cyclic adenosine monophosphate (cAMP)
fungal pathogenicity and, 342, 343
surface attachment and pre-penetration biology of fungi, 385, 395, 397–99, 403–4, 406–7
Cycloheximide
surface attachment and pre-penetration biology of fungi, 387
Cystic fibrosis
Burkholderia cepacia complex diversity and, 225, 227, 230, 236–39, 241, 244–48
common mechanisms for pathogens and, 260–61, 266
Cysts
root
potato resistance gene organization and, 79, 83, 85–86
Cytokinins
leafy gall formation by *Rhodococcus fascians* and, 27, 33–35, 39–40

D

Damping-off diseases
Burkholderia cepacia complex diversity and, 232
dapF gene
rhizosphere colonization by *Pseudomonas* and, 473
Darwinula stevensoni
apomictic polyphagous root-knot nematodes and, 60
Datura metel
apomictic polyphagous root-knot nematodes and, 66
DDT
tropical plant pathology and, 3
D-E-A-D box
leafy gall formation by *Rhodococcus fascians* and, 40
degP gene
common mechanisms for pathogens and, 263, 268–69, 275
Desmodium spp.
variability and genetic structure of plant virus populations, 173

Dianthovirus spp.
plant RNA virus capsid proteins and, 424, 427
Didymella bryoniae
polygalacturonase-inhibiting proteins and defense against fungi, 317
Differential regulation
polygalacturonase-inhibiting proteins and defense against fungi, 324–25
Differential/subtractive cDNA hybridization
fungal pathogenicity and, 350–51
Differentiation
apomictic polyphagous root-knot nematodes and, 70
variability and genetic structure of plant virus populations, 157
Digital diagnostics
turfgrass disease diagnosis and, 135
Diplodia natalensis
polygalacturonase-inhibiting proteins and defense against fungi, 317
Directed manipulation
polygalacturonase-inhibiting proteins and defense against fungi, 329
Distance diagnostics
turfgrass disease diagnosis and, 135
Dithane
tropical plant pathology and, 3
Dithiorella gregaria
polygalacturonase-inhibiting proteins and defense against fungi, 315, 318
Diuaphis noxia
barley yellow rust and, 379
Divergent evolutionary origins
common mechanisms for pathogens and, 259–75
Diversifying selection
resistance gene complexes and, 295–97
Diversity
barley yellow rust and, 371–73, 379
Burkholderia cepacia complex diversity and, 225–48
plant virus populations and, 157–77
Dm3 gene
resistance gene complexes and, 290
DNA viruses
variability and genetic structure of plant virus populations, 167, 175
Drosophila spp.
common mechanisms for pathogens and, 274–75
fungal pathogenicity and, 345
resistance gene complexes and, 286
dsbA gene
common mechanisms for pathogens and, 263, 268, 275
dsp genes
predicting durability of *R* genes and, 200
Durability
R gene, 187–16
Durable resistance
barley yellow rust and, 375
predicting durability of *R* genes and, 212–13
resistance gene complexes and, 285, 300–2

E

EAS gene
surface attachment and pre-penetration biology of fungi, 397
Eca gene
potato resistance gene organization and, 84–85, 92
Ecology
biological control in greenhouse systems and, 122–23
Burkholderia cepacia complex diversity and, 225, 230–38
plant RNA virus capsid proteins and, 419
rhizosphere colonization by *Pseudomonas* and, 480
ECP genes
predicting durability of *R* genes and, 205, 215
Effector class
common mechanisms for pathogens and, 262, 269–73, 275
Elicitors
plant RNA virus capsid proteins and, 436–39
predicting durability of *R* genes and, 201, 205, 207, 215
resistance gene complexes and, 285, 303
Encapsidation
plant RNA virus capsid proteins and, 419–46
Endophytes
Burkholderia cepacia complex diversity and, 232
leafy gall formation by *Rhodococcus fascians* and, 27
Endopolygalacturonases

polygalacturonase-inhibiting proteins and defense against fungi, 313–29
Endosymbionts
plant RNA virus capsid proteins and, 432
eng-1 gene
apomictic polyphagous root-knot nematodes and, 59
Enterobacter agglomerans
Burkholderia cepacia complex diversity and, 246
Environmental Protection Agency (EPA)
biological control in greenhouse systems and, 108, 110
Burkholderia cepacia complex diversity and, 225, 242–47
Enzyme-linked immunosorbent assay (ELISA)
fungal pathogenicity and, 356
Epidemiology
plant RNA virus capsid proteins and, 419
Epistasis
barley yellow rust and, 374
Eragrostis curvula
predicting durability of *R* genes and, 206
Erisyphe spp.
resistance gene complexes and, 287
Erwinia amylovora
predicting durability of *R* genes and, 200
Erwinia carotovora
common mechanisms for pathogens and, 261, 264–65, 268, 273
polygalacturonase-inhibiting proteins and defense against fungi, 316, 318
potato resistance gene organization and, 79, 84–86, 88, 90
Erwinia chrysanthemi
common mechanisms for pathogens and, 265, 268, 272
Erwinia spp.
common mechanisms for pathogens and, 260–61, 264–65, 275
leafy gall formation by *Rhodococcus fascians* and, 29, 31–35, 39
Erysiphe graminis
fungal pathogenicity and, 356
Escherichia coli
common mechanisms for pathogens and, 266, 272
fungal pathogenicity and, 340, 346–47
rhizosphere colonization by *Pseudomonas* and, 469–70, 473, 475, 479
Ethylene
leafy gall formation by *Rhodococcus fascians* and, 35
Ethyl methanesulfonate
predicting durability of *R* genes and, 193
Etridiazole
turfgrass disease diagnosis and, 145
Evolution
apomictic polyphagous root-knot nematodes and, 53, 57–60, 69–70
common mechanisms for pathogens and, 259–75
leafy gall formation by *Rhodococcus fascians* and, 27, 43
plant RNA virus capsid proteins and, 419–22, 429
predicting durability of *R* genes and, 209–12
resistance gene complexes and, 285, 292–98
variability and genetic structure of plant virus populations, 159, 175–77
Exopolysaccharide (EPS)
common mechanisms for pathogens and, 273
Exotoxin A
common mechanisms for pathogens and, 270
expI/exp*R* genes
common mechanisms for pathogens and, 265
Extreme resistance
potato resistance gene organization and, 87

F

Fasciation
leafy gall formation by *Rhodococcus fascians* and, 27–43
fas genes
leafy gall formation by *Rhodococcus fascians* and, 36–40
Fb gene
potato resistance gene organization and, 86
Fenarimol
turfgrass disease diagnosis and, 145
Field resistance
potato resistance gene organization and, 82
Filamentous fungi
fungal pathogenicity and, 337
surface attachment and pre-penetration biology of fungi, 396, 407
Fitness

apomictic polyphagous root-knot nematodes and, 53, 63, 70
predicting durability of *R* genes and, 187–216
rhizosphere colonization by *Pseudomonas* and, 480
variability and genetic structure of plant virus populations, 169
Flagella
common mechanisms for pathogens and, 272–75
rhizosphere colonization by *Pseudomonas* and, 467–68
Flexuous RNA virus coat proteins
plant RNA virus capsid proteins and, 421–22
Fluorescence resonance energy transfer (FRET)
fungal pathogenicity and, 354
Fluorescent in situ hybridization (FISH)
fungal pathogenicity and, 356
Fluorescent probes
fungal pathogenicity and, 340
Flutolanil
turfgrass disease diagnosis and, 144–45
Foliar diseases
biological control in greenhouse systems and, 103–25
Burkholderia cepacia complex diversity and, 234
Folicur®
barley yellow rust and, 377
Foot and mouth disease virus
plant RNA virus capsid proteins and, 444
variability and genetic structure of plant virus populations, 171
Forward genetics
fungal pathogenicity and, 345–48
Fosetyl-al
turfgrass disease diagnosis and, 145
Founder effects
variability and genetic structure of plant virus populations, 164
Frankliniella occidentalis
plant RNA virus capsid proteins and, 433
Freeman EM, 13–24
Functional conservation
common mechanisms for pathogens and, 259
Functional genomics
predicting durability of *R* genes and, 214–15
rhizosphere colonization by *Pseudomonas* and, 480–81
surface attachment and pre-penetration biology of fungi, 407
Fungi
apomictic polyphagous root-knot nematodes and, 53–55, 59–60, 68–69
barley yellow rust and, 367–407
Burkholderia *cepacia* complex diversity and, 232–34
cereal diseases and, 15–19
common mechanisms for pathogens and, 261, 270
leafy gall formation by *Rhodococcus fascians* and, 37
pathogenicity and *Agrobacterium*-tagged mutagenesis, 347–48
antibodies, 344–45
cell separation, 354–55
conclusions, 356–57
differential display of mRNA, 351–52
differential/subtractive cDNA hybridization, 350–51
expression pattern approaches for gene identification, 350–52
FISH detection, 356
fluorescent labeling methods, 339–41
fluorescent probes, 340
forward genetics, 345–48
gene clusters, 350
genetics, 345–50
genomics, 353–54
green fluorescent protein, 340–41
homology-based reverse genetics, 348–49
immunocytochemistry, 339–40
immunological detection, 356
in planta techniques, 354–56
insertional mutagenesis, 346–47
introduction, 338
laser scanning confocal microscopy, 341–42
microarrays, 352
microscopy, 339–42
mutant complementation, 345–46
obligate biotrophs, 356
PCR-based detection, 355–56
peptide inhibitors, 344–45
pharmacology, 342–44
plantibodies, 344–45
protein-based reverse

genetics, 349–50
protein targeting, 342–45
REMI mutagenesis, 347
reverse genetics, 348–50
signature-tagged mutagenesis, 348
plant RNA virus capsid proteins and, 434–35
polygalacturonase-inhibiting proteins and, 313–29
potato resistance gene organization and, 79, 81, 87–90, 92, 94
predicting durability of *R* genes and, 189, 193, 204–7, 214
resistance gene complexes and, 288
rhizosphere colonization by *Pseudomonas* and, 465
surface attachment and pre-penetration stage development, 385–407
turfgrass disease diagnosis and, 138
variability and genetic structure of plant virus populations, 159, 165
Fungicides
barley yellow rust and, 376–80
biological control in greenhouse systems and, 103, 106, 121, 125
Burkholderia cepacia complex diversity and, 242
fungal pathogenicity and, 343
tropical plant pathology and, 3
Furovirus spp.
plant RNA virus capsid proteins and, 435
Fusarium oxysporum
biological control in greenhouse systems and, 109–10
fungal pathogenicity and, 348
polygalacturonase-inhibiting proteins and defense against fungi, 315–16, 318
potato resistance gene organization and, 90–91
predicting durability of *R* genes and, 190
rhizosphere colonization by *Pseudomonas* and, 464, 471, 476
Fusarium spp.
apomictic polyphagous root-knot nematodes and, 68
biological control in greenhouse systems and, 103
Burkholderia cepacia complex diversity and, 232–33
fungal pathogenicity and, 348
polygalacturonase-inhibiting proteins and defense against fungi, 315–18
resistance gene complexes and, 287–88
fuz7 gene
fungal pathogenicity and, 349

G

gac genes
common mechanisms for pathogens and, 263–64
rhizosphere colonization by *Pseudomonas* and, 480
Gaeumannomyces spp.
fungal pathogenicity and, 350
rhizosphere colonization by *Pseudomonas* and, 479
turfgrass disease diagnosis and, 143, 145
Galls
leafy gall formation by *Rhodococcus fascians* and, 27–43
Gene clusters
fungal pathogenicity and, 350
potato resistance gene organization and, 79, 89–90, 92
Gene deployment
barley yellow rust and, 375
Gene flow
predicting durability of *R* genes and, 215, 216
Gene-for-genome hypothesis
apomictic polyphagous root-knot nematodes and, 65
General field resistance
barley yellow rust and, 367
Genetic drift
barley yellow rust and, 373
variability and genetic structure of plant virus populations, 157, 163–65
Genetic engineering
resistance gene complexes and, 285
tropical plant pathology and, 9
Genetic mapping
potato resistance gene organization and, 79, 82–83, 85–91
Gene transfer
Burkholderia cepacia complex diversity and, 241–42
Genomics
Burkholderia cepacia complex diversity and, 225, 227–30

fungal pathogenicity and, 337, 353–54
plant RNA virus capsid proteins and, 419, 435–36
potato resistance gene organization and, 79–95
predicting durability of *R* genes and, 214–15
rhizosphere colonization by *Pseudomonas* and, 480–81
surface attachment and pre-penetration biology of fungi, 385, 407
variability and genetic structure of plant virus populations, 157–77
Genomovars
Burkholderia cepacia complex diversity and, 225, 228–30, 239–40, 247
Germplasm
predicting durability of *R* genes and, 187–216
Germ tube elongation
surface attachment and pre-penetration biology of fungi, 385, 389–97
Gibberella zeae
barley yellow rust and, 379
Gibberellins
leafy gall formation by *Rhodococcus fascians* and, 35
GL-21
biological control in greenhouse systems and, 108
Gliocladium spp.
biological control in greenhouse systems and, 103, 107–9
GlioGard®
biological control in greenhouse systems and, 108
Globodera spp.
potato resistance gene organization and, 82–86, 89–90
resistance gene complexes and, 287
Glomerella cingulata
polygalacturonase-inhibiting proteins and defense against fungi, 316–17
Glu genes
potato resistance gene organization and, 93
Gnotobiotic system
rhizosphere colonization by *Pseudomonas* and, 463–65
Golf courses
turfgrass disease diagnosis and, 135, 140–44, 146–48
Gordona spp.
leafy gall formation by *Rhodococcus fascians* and, 29
gpa genes
fungal pathogenicity and, 349
potato resistance gene organization and, 84–86, 89
"Grain mentality"
tropical plant pathology and, 6
Gram-negative bacteria
Burkholderia cepacia complex diversity and, 225–48
common mechanisms for pathogens and, 260–75
rhizosphere colonization by *Pseudomonas* and, 461–80
Gram-positive bacteria
common mechanisms for pathogens and, 263, 267
leafy gall formation by *Rhodocuccus fascians* and, 27–43
Green fluorescent protein
fungal pathogenicity and, 339–41, 354
rhizosphere colonization by *Pseudomonas* and, 463, 465
Greenhouse systems
biological control and
Ampelomyces quisqualis, 110–11
Bacillus subtilis strain QST713, 111–12
Bacillus subtilis var. *amyloliquefaciens* FZB 24, 109–10
Canadian research, 112–20
conclusions, 125
Coniothyrium minitans, 107
ecology, 122–23
foliar pathogens, 110–12
future research, 120–24
Gliocladium catenulatum strain J1446, 109
Gliocladium virens, 108
hydroponics, 112–17
introduction, 104–6
non-pathogenic *Fusarium oxysporum* strain Fo47, 109
powdery mildews, 117–20
Pythium spp., 112–17
soilborne pathogens, 107–10
Streptomyces griseoviridis strain K61, 108–9
suitability, 105–6
Trichoderma harzianum strain T-22, 108
Trichoderma harzianum strain T-39, 111
Trichoderma virens, 108

Ulocladium atrum, 112
unique disease problems, 105
Green islands
leafy gall formation by *Rhodococcus fascians* and, 30
gro genes
potato resistance gene organization and, 84–86, 89, 92
Groundnut rosette virus
plant RNA virus capsid proteins and, 423
variability and genetic structure of plant virus populations, 158, 168
Grp1 gene
potato resistance gene organization and, 84, 86, 93

H

34H4 gene
common mechanisms for pathogens and, 271
H1 gene
potato resistance gene organization and, 82, 86, 89
Haemophilus influenzae
Burkholderia cepacia complex diversity and, 236
rhizosphere colonization by *Pseudomonas* and, 469
Hepatitis C virus
variability and genetic structure of plant virus populations, 171
Hero gene
potato resistance gene organization and, 90
Heterodera spp.
apomictic polyphagous root-knot nematodes and, 60
resistance gene complexes and, 287
Histidine
leafy gall formation by *Rhodococcus fascians* and, 38, 41
Hm1 gene
resistance gene complexes and, 289
Homology-based reverse genetics
fungal pathogenicity and, 348–49
Hop stunt viroid
variability and genetic structure of plant virus populations, 158, 165
Hordeivirus spp.
plant RNA virus capsid proteins and, 426
Hordeum jubatum
barley yellow rust and, 370
Horizontal resistance
potato resistance gene organization and, 82
Hormones
leafy gall formation by *Rhodococcus fascians* and, 28, 32–35
Host range
apomictic polyphagous root-knot nematodes and, 53, 62–64, 67
Host resistance
apomictic polyphagous root-knot nematodes and, 53
plant RNA virus capsid proteins and, 419–46
predicting durability of *R* genes and, 187–216
variability and genetic structure of plant virus populations, 157–77
Host surface perception
surface attachment and pre-penetration biology of fungi, 389–97
Hotspots
predicting durability of *R* genes and, 187–216
variability and genetic structure of plant virus populations, 162
hrcC gene
rhizosphere colonization by *Pseudomonas* and, 473
hrp genes
predicting durability of *R* genes and, 198–200
rhizosphere colonization by *Pseudomonas* and, 473
hrpM gene
common mechanisms for pathogens and, 271, 275
HRT gene
plant RNA virus capsid proteins and, 438–39
htrB gene
rhizosphere colonization by *Pseudomonas* and, 469
Human immunodeficiency virus 1 (HIV-1)
variability and genetic structure of plant virus populations, 164
Hybridization
apomictic polyphagous root-knot nematodes and, 58–59
Hydrophobins
surface attachment and pre-penetration biology of fungi, 385, 393–97
Hydroponics
biological control in greenhouse systems and, 103, 105, 112–17
hyp genes
leafy gall formation by *Rhodococcus fascians* and, 40–42
Hyphae
cereal diseases and, 15–16

I
IBMX
fungal pathogenicity and, 342–43
Icosahedral RNA virus coat proteins
plant RNA virus capsid proteins and, 421
Ilarvirus spp.
plant RNA virus capsid proteins and, 436
inA gene
rhizosphere colonization by *Pseudomonas* and, 475
Indigenous population size
Burkholderia cepacia complex diversity and, 230–31
Indole-3-acetic acid (IAA)
leafy gall formation by *Rhodococcus fascians* and, 34, 39
infl gene
predicting durability of *R* genes and, 207
"Infection capabilities"
cereal diseases and, 17
Influenza A virus
variability and genetic structure of plant virus populations, 171
Innate defense response
common mechanisms for pathogens and, 274–75
In planta techniques
fungal pathogenicity and, 337, 339, 350–51, 354–56
Insects
common mechanisms for pathogens and, 274–75
Insertional mutagenesis
fungal pathogenicity and, 346–47
Integrins
surface attachment and pre-penetration biology of fungi, 385, 391–93
International agriculture
tropical plant pathology and, 1
Interspecific transfer
resistance gene complexes and, 299–300
Intraspecific genetic variability
barley yellow rust and, 372
Invasion
apomictic polyphagous root-knot nematodes and, 65–67
Iprodione
turfgrass disease diagnosis and, 145
ipt gene
leafy gall formation by *Rhodococcus fascians* and, 33–34, 36–37
IRAT7 gene
predicting durability of *R* genes and, 206
Isopentenyl adenine
leafy gall formation by *Rhodococcus fascians* and, 39

J
Juvenile invasion
apomictic polyphagous root-knot nematodes and, 53, 56, 58

K
Kennedya rubicunda
variability and genetic structure of plant virus populations, 173
Kennedya yellow mosaic virus
variability and genetic structure of plant virus populations, 158, 165, 173
Klebsiella pneumoniae
common mechanisms for pathogens and, 268, 271
rhizosphere colonization by *Pseudomonas* and, 479
Kodiak®
biological control in greenhouse systems and, 109
Koni®
biological control in greenhouse systems and, 107

L
lac-1 gene
fungal pathogenicity and, 343
lacZ operon
rhizosphere colonization by *Pseudomonas* and, 463, 467, 471, 478
Laetisaria spp.
turfgrass disease diagnosis and, 142
Lamina
leafy gall formation by *Rhodococcus fascians* and, 30
Lanzia spp.
turfgrass disease diagnosis and, 142, 145
Laser scanning confocal microscopy
fungal pathogenicity and, 341–42
lasI/lasR system
common mechanisms for pathogens and, 265–67
lasR gene
common mechanisms for pathogens and, 263
Late blight
potato resistance gene organization and, 79, 88
Lateral gene transfer
predicting durability of *R* genes and, 215–16
Lathyrus odoratus

leafy gall formation by *Rhodococcus fascians* and, 28
Leafy gall formation by *Rhodococcus fascians*
att locus, 40–42
auxins, 34–35
causal agent, 28–29
colonization, 31–32, 42–43
cytokinins, 33–34
fas genes, 36–40
hyp locus, 40–42
introduction, 28
metabolic colonization, 42–43
molecular genetics of virulence genes, 35–42
phytohormones, 32–35
regulation, 36–39
sequencing, 36–38
symptom colonization, 31–32
symptom development, 29–31
Leaves
barley yellow rust and, 376–78
Burkholderia cepacia complex diversity and, 234
predicting durability of *R* genes and, 211
lemA gene
common mechanisms for pathogens and, 263
Lettuce infectious yellows virus
plant RNA virus capsid proteins and, 426
Leucine-rich repeat proteins
polygalacturonase-inhibiting proteins and defense against fungi, 313, 326–27, 329
lexA gene
rhizosphere colonization by *Pseudomonas* and, 480
Linear plasmid
leafy gall formation by *Rhodococcus fascians* and, 27, 36, 39, 41
Linkage analysis
potato resistance gene organization and, 82, 89–90, 92–93, 95
lipA gene
rhizosphere colonization by *Pseudomonas* and, 475
Lipopolysaccharide (LPS)
common mechanisms for pathogens and, 273, 275
rhizosphere colonization by *Pseudomonas* and, 469, 475, 479
Lolium temelentum
cereal diseases and, 15–16
lppL gene
rhizosphere colonization by *Pseudomonas* and, 473
Lr genes
predicting durability of *R* genes and, 190
Lupinus alba
polygalacturonase-inhibiting proteins and defense against fungi, 314
Luteovirus spp.
plant RNA virus capsid proteins and, 421, 432, 434–35, 446
Lycopersicon peruvianum
apomictic polyphagous root-knot nematodes and, 61
lysA gene
rhizosphere colonization by *Pseudomonas* and, 473
Lysine
leafy gall formation by *Rhodococcus fascians* and, 39
LysR-like transcriptional regulator
common mechanisms for pathogens and, 267

M

Macrophomina phaseolicola
polygalacturonase-inhibiting proteins and defense against fungi, 317
Macrosiphum spp.
apomictic polyphagous root-knot nematodes and, 61
resistance gene complexes and, 287
MAGB gene
surface attachment and pre-penetration biology of fungi, 397–98
Magnoporthe grisea
fungal pathogenicity and, 337, 341–44, 346–47, 349, 353
predicting durability of *R* genes and, 201, 205–6, 208, 214–15
resistance gene complexes and, 287–88
surface attachment and pre-penetration biology of fungi, 387, 389–92, 394–95, 397–407
turfgrass disease diagnosis and, 143, 145
Maize
tropical plant pathology and, 5
Malting cultivars
barley yellow rust and, 367–69
Mammals
common mechanisms for pathogens and, 274–75
Management groups
turfgrass disease diagnosis and, 135, 144–48
Mancozeb
turfgrass disease diagnosis and, 145

Manihot esculenta
tropical plant pathology and, 6
Marker-assisted selection
potato resistance gene organization and, 79, 94–95
mdh operon
rhizosphere colonization by *Pseudomonas* and, 472
mdo genes
common mechanisms for pathogens and, 271
Medicago trunculata
plant RNA virus capsid proteins and, 445
Mefonoxam
turfgrass disease diagnosis and, 145
Me genes
apomictic polyphagous root-knot nematodes and, 62
Meiotic parthenogenesis
apomictic polyphagous root-knot nematodes and, 58
Melampsora lini
predicting durability of *R* genes and, 193
resistance gene complexes and, 287, 289
Meloidogyne spp.
apomictic polyphagous root-knot nematodes and, 53–59, 61–68
biotrophic root pathogenicity and, 53–70
potato resistance gene organization and, 83, 86
resistance gene complexes and, 287–88
turfgrass disease diagnosis and, 143, 147
Meristem
leafy gall formation by *Rhodococcus fascians* and, 27–28, 30
Metabolic colonization
leafy gall formation by *Rhodococcus fascians* and, 27, 42–43
Metabolic habitat modification
leafy gall formation by *Rhodococcus fascians* and, 43
Methyl bromide
Burkholderia cepacia complex diversity and, 242
MeuI gene
potato resistance gene organization and, 90
Microarrays
fungal pathogenicity and, 337, 352
Microbial adhesion
surface attachment and pre-penetration biology of fungi, 385, 388
Microbial biological control organisms
Burkholderia cepacia complex diversity and, 242–44
Microbial functional genomics
predicting durability of *R* genes and, 214–15
Microbial pathogenesis
common mechanisms for pathogens and, 259–75
Microbial pest control agents
biological control in greenhouse systems and, 122
Microcolonies
rhizosphere colonization by *Pseudomonas* and, 477
Microdochium spp.
turfgrass disease diagnosis and, 142, 145
Mi gene
apomictic polyphagous root-knot nematodes and, 61–63
potato resistance gene organization and, 90
resistance gene complexes and, 288
Mink enteritis virus
plant RNA virus capsid proteins and, 443
Mirror orientation selection
fungal pathogenicity and, 351
Mitochondrial DNA (mtDNA)
apomictic polyphagous root-knot nematodes and, 59, 61
Mitogen-activated protein kinase (MAPK)-mediated signaling pathways
surface attachment and pre-penetration biology of fungi, 385, 397, 399–403, 407
Mitotic parthenogenesis
apomictic polyphagous root-knot nematodes and, 53–70
Molecular linkage mapping
potato resistance gene organization and, 83, 85–91
Monogenic resistance
potato resistance gene organization and, 83, 91–94
Motility
plant RNA virus capsid proteins and, 419, 422–29
rhizosphere colonization by *Pseudomonas* and, 467–69
moxR gene
rhizosphere colonization

by *Pseudomonas* and, 478, 480
mpg1 gene
surface attachment and pre-penetration biology of fungi, 394–95, 397
mucD gene
common mechanisms for pathogens and, 263, 269
Multi-gene complexes
resistance gene complexes and, 298
Multihost pathogenesis system
common mechanisms for pathogens and, 262, 269
Multilines
barley yellow rust and, 375
Mutant complementation
fungal pathogenicity and, 345–46
mvfR gene
common mechanisms for pathogens and, 263, 267
Myclobutanil
turfgrass disease diagnosis and, 145
Mycobacterium spp.
leafy gall formation by *Rhodococcus fascians* and, 29, 36
Mycoplasm theory
cereal diseases and, 15
Mycorrhizae
apomictic polyphagous root-knot nematodes and, 53–55, 60, 68–69
Mycosphaerella spp.
polygalacturonase-inhibiting proteins and defense against fungi, 318
surface attachment and pre-penetration biology of fungi, 407
Mycostop®
biological control in greenhouse systems and, 108–9
Myzus persicae
variability and genetic structure of plant virus populations, 174

N

N gene
potato resistance gene organization and, 90
Na_{adg} gene
potato resistance gene organization and, 85, 87
NADH dehydrogenases
rhizosphere colonization by *Pseudomonas* and, 475–76
Naphthalene
rhizosphere colonization by *Pseudomonas* and, 479–80
Nb gene
potato resistance gene organization and, 84
NBS/CeY-Lrr genes
potato resistance gene organization and, 92–93
ndh gene
rhizosphere colonization by *Pseudomonas* and, 476
Necrovirus spp.
plant RNA virus capsid proteins and, 434
Nectria galligena
polygalacturonase-inhibiting proteins and defense against fungi, 316
Nectria haematococca
fungal pathogenicity and, 343–44, 350
leafy gall formation by *Rhodococcus fascians* and, 37
surface attachment and pre-penetration biology of fungi, 387
Negative selection
variability and genetic structure of plant virus populations, 157, 163, 166, 169
Neisseria meningitidis
Burkholderia cepacia complex diversity and, 241
Nematodes
apomictic polyphagous root-knot nematodes and, 53–70
plant RNA virus capsid proteins and, 433–34
potato resistance gene organization and, 79, 83, 85–86
Neurospora crassa
fungal pathogenicity and, 337, 353
surface attachment and pre-penetration biology of fungi, 397
Nicotiana benthamiana
plant RNA virus capsid proteins and, 424–27, 438, 440, 444
predicting durability of *R* genes and, 207
Nicotiana spp.
plant RNA virus capsid proteins and, 423–24, 426–27, 437, 440, 444
variability and genetic structure of plant virus populations, 164–65, 173
nip1 gene
fungal pathogenicity and, 350
predicting durability of *R* genes and, 206–7
Nocardia spp.
leafy gall formation by *Rhodococcus fascians* and, 29
Nongovernmental agencies

(NGOs)
tropical plant pathology and, 5
Nonpersistent transmission
plant RNA virus capsid proteins and, 430–31
Nosocomial infections
common mechanisms for pathogens and, 260
Nrf1 gene
predicting durability of *R* genes and, 204–5
NtPR genes
potato resistance gene organization and, 93
nuo operon
rhizosphere colonization by *Pseudomonas* and, 475–76

O

Obligate biotrophs
fungal pathogenicity and, 356
Odontoglossum ringspot virus
plant RNA virus capsid proteins and, 423–24
Ol-1 gene
potato resistance gene organization and, 90
Olpidium spp.
plant RNA virus capsid proteins and, 434
Ophiospherella spp.
turfgrass disease diagnosis and, 142–43, 145
Ophiostoma ulmi
surface attachment and pre-penetration biology of fungi, 395
Opportunistic human pathogens
Burkholderia cepacia complex diversity and, 235–37, 246–47
Ornibactins
Burkholderia cepacia complex diversity and, 233, 238
Oscillatoria spp.
turfgrass disease diagnosis and, 145
Osm gene
potato resistance gene organization and, 93
Ostracods
apomictic polyphagous root-knot nematodes and, 53, 60
Outer membrane permeability
rhizosphere colonization by *Pseudomonas* and, 475
"Overcoat" technology
plant RNA virus capsid proteins and, 443

P

Panicum mosaic virus
variability and genetic structure of plant virus populations, 158, 175
Pantoea agglomerans
Burkholderia cepacia complex diversity and, 246
parA1 gene
predicting durability of *R* genes and, 207
Paratrichodorus anemones
plant RNA virus capsid proteins and, 433
Parthenogenesis
apomictic polyphagous root-knot nematodes and, 53, 57–58, 67, 70
Parthenogenetic bdelloid rotifers
apomictic polyphagous root-knot nematodes and, 53, 60–61
Partial resistance
apomictic polyphagous root-knot nematodes and, 66
Pasteuria penetrans
apomictic polyphagous root-knot nematodes and, 53, 55, 62
Pathogen fitness penalty
predicting durability of *R* genes and
avirulence genes, 193–207
avrBs3 gene family, 194
bacterial avirulence genes, 193–204
caveats, 212–16
Cladosporidium fulvum, 204–5
conclusions, 216
designing plant genotypes, 213
durability of disease resistance, 190–91
durable resistance, 212–13
elicitors, 207
evolution, 209–12
field studies, 209–14
fitness, 191–93, 207–8
fungal avirulence genes, 204–7
future research, 212–16
gene flow, 215–16
genetic recombination, 215–16
introduction, 188–89
Magnoporthe grisea, 205–6
microbial functional genomics, 214–15
mutability, 193, 215–16
Phytophthora infestans, 207
Phytophthora parasitica, 207
population genetics, 213–14
population level, 208–12

questions, 212–16
Rhyncosporium secalis virulence factors, 206–7
stabilizing selection, 191–93
summary, 207–8
Xanthomonas campestris pv. *vesicatoria*, 194, 209–10
Xanthomonas oryzae pv. *oryzae*, 210–12
Pathogenicity islands
Burkholderia cepacia complex diversity and, 226
predicting durability of *R* genes and, 203
PCNB
Burkholderia cepacia complex diversity and, 242
turfgrass disease diagnosis and, 145
PDA1 gene
fungal pathogenicity and, 350
Peach latent mosaic viroid
variability and genetic structure of plant virus populations, 158, 160, 174
Pea early-browning virus
plant RNA virus capsid proteins and, 433–34
Peanut stripe virus
variability and genetic structure of plant virus populations, 158
Pecluvirus spp.
plant RNA virus capsid proteins and, 435
pehA gene
Burkholderia cepacia complex diversity and, 235
Pelargonium zonale
leafy gall formation by *Rhodococcus fascians* and, 33
Penicillum expansum
Burkholderia cepacia complex diversity and, 234
polygalacturonase-inhibiting proteins and defense against fungi, 315–16
Penicillum syringae
polygalacturonase-inhibiting proteins and defense against fungi, 316
PEP genes
fungal pathogenicity and, 350
Pepper mild mottle virus
plant RNA virus capsid proteins and, 437
variability and genetic structure of plant virus populations, 158, 173
Peronospora spp.
resistance gene complexes and, 287
Persistence
Burkholderia cepacia complex diversity and, 234
plant RNA virus capsid proteins and, 431–33
Pesticides
biological control in greenhouse systems and, 103, 124
Burkholderia cepacia complex diversity and, 242–43
Pflanzenstärkungsmittel
biological control in greenhouse systems and, 107
pgip genes
polygalacturonase-inhibiting proteins and defense against fungi, 313–29
Phaseolus vulgaris
polygalacturonase-inhibiting proteins and defense against fungi, 315
Phenazines
Burkholderia cepacia complex diversity and, 233
common mechanisms for pathogens and, 263, 270
Phenylpyrroles
Burkholderia cepacia complex diversity and, 233, 242
phnAB operon
common mechanisms for pathogens and, 270–71
Phoma spp.
polygalacturonase-inhibiting proteins and defense against fungi, 317
Phospholipase C
common mechanisms for pathogens and, 269–70
Phytomonas fascians
leafy gall formation by *Rhodococcus fascians* and, 28
Phytophthora infestans
apomictic polyphagous root-knot nematodes and, 69
fungal pathogenicity and, 351, 353
potato resistance gene organization and, 79, 80, 84–92
predicting durability of *R* genes and, 201, 207
tropical plant pathology and, 1, 6–8
Phytophthora spp.
biological control in

greenhouse systems and, 110
fungal pathogenicity and, 340–41, 352
predicting durability of *R* genes and, 201, 207–8
Phytoreovirus spp.
variability and genetic structure of plant virus populations, 169
Phytostimulators
rhizosphere colonization by *Pseudomonas* and, 461
phz genes
common mechanisms for pathogens and, 263, 270
rhizosphere colonization by *Pseudomonas* and, 480
Pi gene
potato resistance gene organization and, 84–85
pil genes
rhizosphere colonization by *Pseudomonas* and, 468–69
Pili
rhizosphere colonization by *Pseudomonas* and, 468–69
Pin genes
potato resistance gene organization and, 93
pita gene
predicting durability of *R* genes and, 205
resistance gene complexes and, 288
Plantibodies
fungal pathogenicity and, 344–45
Plant RNA viruses
capsid proteins and, 419–46
PlantShield®
biological control in greenhouse systems and, 108
Plant virus populations
variability and genetic structure of
complementation, 169–70
conclusions, 175–77
diversity, 170–72
genetic drift, 163–65
genetic structure, 163–171, 173–75
heterogeneity, 159–61
introduction, 158–59
selection, 165–69
sources of genetic variation, 161–63
Plasmids
leafy gall formation by *Rhodococcus fascians* and, 27, 36, 39, 41
plcS gene
common mechanisms for pathogens and, 263, 270, 275
pME6010
rhizosphere colonization by *Pseudomonas* and, 465
Poa annua
turfgrass disease diagnosis and, 138, 143, 147
Poliovirus
variability and genetic structure of plant virus populations, 162
Polygalacturonase-inhibiting proteins (PGIPs)
defense against pathogenic fungi and
conclusions, 328–29
defense, 326
differential regulation, 324–25
distribution in plant kingdom, 314
genetics, 315, 320–24
homogeneity, 322
introduction, 314
leucine-rich repeat proteins, 326–27
primary structure comparisons, 323–24
recognition abilities, 314–22
structural basis of endopolygalacturonase-PGIP interaction, 327–28
Polygenic resistance
potato resistance gene organization and, 79, 82–83, 91–94
Polymerase chain reaction (PCR)
Burkholderia cepacia complex diversity and, 231
fungal pathogenicity and, 338, 349, 351, 355–56
potato resistance gene organization and, 83, 94
turfgrass disease diagnosis and, 135, 148–49
Polymyxa spp.
plant RNA virus capsid proteins and, 434
Polymyxin B
rhizosphere colonization by *Pseudomonas* and, 475
Polyphagy
apomictic polyphagous root-knot nematodes and, 55–59, 68–69
Pomovirus spp.
plant RNA virus capsid proteins and, 435
Population dynamics
Burkholderia cepacia complex diversity and, 230, 233–34
plant virus populations and, 157–77
predicting durability of *R* genes and, 208–12
Population genetics
predicting durability of *R*

genes and, 213–14
Positive selection
variability and genetic structure of plant virus populations, 163
Postia placenta
polygalacturonase-inhibiting proteins and defense against fungi, 318
Potato
cereal diseases and, 23
tropical plant pathology and, 2–4, 6
Potato aucuba mosaic virus
plant RNA virus capsid proteins and, 430
Potato leaf roll virus
plant RNA virus capsid proteins and, 432
potato resistance gene organization and, 86–87
tropical plant pathology and, 7
variability and genetic structure of plant virus populations, 158, 168
Potato mop-top virus
plant RNA virus capsid proteins and, 435
potato resistance gene organization and, 87
Potato resistance gene organization
candidate genes for marker-assisted resistance breeding, 94–95
cloning, 91–92
comparison of function maps for resistance between solanaceous species, 90–91
conclusions from location of potato genes for resistance, 89–91
gene clusters, 89
history of resistance breeding, 80–81
inheritance of disease resistance, 81–82
introduction, 80–83
linkage analysis, 89–90, 92–93
map positions of potato genes
for resistance to bacteria, 88–89
for resistance to fungi, 87–88
for resistance to nematodes, 83, 85–86
for resistance to viruses, 86–87
models for outcome of *R* gene-mediated and quantitative resistance, 93–94
monogenic resistance, 91–94
new tools for genetic analysis of disease resistance, 82–85
outlook, 95
polygenic resistance, 91–94
Potato virus A
potato resistance gene organization and, 86–87
variability and genetic structure of plant virus populations, 158, 168
Potato virus M
potato resistance gene organization and, 86–87
Potato virus S
potato resistance gene organization and, 87
Potato virus V
variability and genetic structure of plant virus populations, 158, 168
Potato virus X
plant RNA virus capsid proteins and, 428–30, 438–39
potato resistance gene organization and, 81, 86–87, 94
predicting durability of *R* genes and, 205
Potato virus Y
plant RNA virus capsid proteins and, 431
potato resistance gene organization and, 80–81, 86, 94–95
variability and genetic structure of plant virus populations, 158, 168, 173
Potato wart
potato resistance gene organization and, 88, 94
Potexvirus spp.
plant RNA virus capsid proteins and, 430, 435
pot genes
rhizosphere colonization by *Pseudomonas* and, 472
Potyvirus spp.
plant RNA virus capsid proteins and, 425, 429–30, 434, 440–41
Powdery mildew
biological control in greenhouse systems and, 103, 105–6, 117–20
Pre-penetration biology of fungi
surface attachment and appressorium, 397–406
conclusions, 406–7
functional genomics, 407
future research, 406–7
host surface perception, 389–97
hydrophobins, 393–97
inductive signal transmission for appressorium

morphogenesis, 397–406
integrins, 391–93
introduction, 386
MAPK-mediated signaling pathways for infection-related development, 399–403
second messenger stimulation, 397–99
signal perception, 397–99
spore attachment mechanisms, 386–88
spore germination, 389–97
surface hardness, 389–91
thigmotropism, 389–91
Prf gene
fungal pathogenicity and, 349
resistance gene complexes and, 288, 290
Primastop®
biological control in greenhouse systems and, 109
Promoters
rhizosphere colonization by *Pseudomonas* and, 478
Propamocarb
turfgrass disease diagnosis and, 145
Propiconazole
barley yellow rust and, 377–78
turfgrass disease diagnosis and, 145
Protein-based reverse genetics
fungal pathogenicity and, 349–50
Protein kinase A (PKA)
fungal pathogenicity and, 342–43
Protein targeting
fungal pathogenicity and, 342–45
Prototrophy
rhizosphere colonization by *Pseudomonas* and, 470–71
Prunus necrotic ringspot virus
variability and genetic structure of plant virus populations, 158, 165
Pseudanes
Burkholderia cepacia complex diversity and, 233
Pseudobactin M114
rhizosphere colonization by *Pseudomonas* and, 480
Pseudomonas aeruginosa
Burkholderia cepacia complex diversity and, 236–38, 240, 247
common mechanisms for pathogens and, 260–62, 264–73, 275
rhizosphere colonization and, 468, 473–75, 478–80
Pseudomonas aurefaciens
common mechanisms for pathogens and, 270
Pseudomonas avenae
common mechanisms for pathogens and, 273
Pseudomonas brassicacearum
rhizosphere colonization and, 474–75
Pseudomonas cepacia
Burkholderia cepacia complex diversity and, 226, 235
Pseudomonas chlororaphis
rhizosphere colonization and, 464, 474, 476
Pseudomonas fluorescens
common mechanisms for pathogens and, 270, 272
rhizosphere colonization and, 463–68, 470–77, 479–81
Pseudomonas marginalis
common mechanisms for pathogens and, 264
Pseudomonas putida
rhizosphere colonization and, 470, 476, 478, 480
Pseudomonas savastanoi
leafy gall formation by *Rhodococcus fascians* and, 29, 31–34, 39
Pseudomonas solanacearum
common mechanisms for pathogens and, 273
tropical plant pathology and, 6
Pseudomonas spp.
biological control in greenhouse systems and, 103, 107, 109, 124
resistance gene complexes and, 287
rhizosphere colonization and, 461–80
Pseudomonas syringae
Burkholderia cepacia complex diversity and, 237
common mechanisms for pathogens and, 263–64, 268–69, 271–72
predicting durability of *R* genes and, 198–200, 203, 206, 208
rhizosphere colonization and, 473
Pseudomonas viridiflava
common mechanisms for pathogens and, 264
Pseudozyma flocculosa
biological control in greenhouse systems and, 103, 117–19
pspB gene
rhizosphere colonization by *Pseudomonas* and, 475

pth genes
fungal pathogenicity and, 347
predicting durability of *R* genes and, 194, 197, 202, 207–8
surface attachment and pre-penetration biology of fungi, 397
Pto gene
resistance gene complexes and, 288, 290
Puccinia graminis
cereal diseases and, 16
fungal pathogenicity and, 356
predicting durability of *R* genes and, 193, 212
surface attachment and pre-penetration biology of fungi, 390
Puccinia spp.
barley yellow rust and, 367–407
cereal diseases and, 15–17
predicting durability of *R* genes and, 190
resistance gene complexes and, 287
Purifying selection
variability and genetic structure of plant virus populations, 163
Putrescine
rhizosphere colonization by *Pseudomonas* and, 472–73
PWL genes
fungal pathogenicity and, 346
predicting durability of *R* genes and, 201, 206, 208
Pyochelin
Burkholderia cepacia complex diversity and, 233, 238
Pyramiding
barley yellow rust and, 375
Pyrenophora tritici-repentis
fungal pathogenicity and, 349
pyr genes
rhizosphere colonization by *Pseudomonas* and, 471
Pyricularia spp.
turfgrass disease diagnosis and, 142, 145
Pyrimidine
barley yellow rust and, 376
Pyrrolnitrin
Burkholderia cepacia complex diversity and, 233
Pythium root rot
biological control in greenhouse systems and, 103, 107, 110, 113, 116
Pythium spp.
biological control in greenhouse systems and, 103–7, 109–10, 112–17, 124
Burkholderia cepacia complex diversity and, 232–33
turfgrass disease diagnosis and, 138, 142–43, 145–46
Pythium ultimum
biological control in greenhouse systems and, 108, 111
rhizosphere colonization by *Pseudomonas* and, 479–80

Q

Quadrus®
barley yellow rust and, 377
Quantitative resistance
potato resistance gene organization and, 92–94
Quantitative trait loci (QTLs)
barley yellow rust and, 375
potato resistance gene organization and, 79–80, 84–86, 88–95
Quasispecies concept
variability and genetic structure of plant virus populations, 160–61
Quinolinones
Burkholderia cepacia complex diversity and, 233
Quorum sensing
Burkholderia cepacia complex diversity and, 233
common mechanisms for pathogens and, 262–67
rhizosphere colonization by *Pseudomonas* and, 477

R

Race variation
barley yellow rust and, 372–73
cereal diseases and, 16
Ralstonia solanacearum
common mechanisms for pathogens and, 273
tropical plant pathology and, 1, 6–8
Random amplified polymorphic DNA (RAPD) typing
barley yellow rust and, 374
Burkholderia cepacia complex diversity and, 239, 241, 248
potato resistance gene organization and, 87
"Red carpet" response
apomictic polyphagous root-knot nematodes and, 68
Red fluorescent protein
rhizosphere colonization by *Pseudomonas* and, 465
Reduced invasion
apomictic polyphagous

root-knot nematodes and, 67
Registration
biological control in greenhouse systems and, 103, 121–22, 124
Burkholderia cepacia complex diversity and, 245–46
Regulator class
common mechanisms for pathogens and, 262–68, 275
Reovirus spp.
plant RNA virus capsid proteins and, 432, 433
rep1 gene
fungal pathogenicity and, 349
"Residual effect"
predicting durability of *R* genes and, 191
Resistance
apomictic polyphagous root-knot nematodes and, 64–68
barley yellow rust and, 367, 373–75, 380
fungicide
biological control in greenhouse systems and, 106
plant RNA virus capsid proteins and, 419, 440–42
polygalacturonase-inhibiting proteins and defense against fungi, 313–29
predicting durability of *R* genes and, 187–216
variability and genetic structure of plant virus populations, 170
Resistance breeding
potato resistance gene organization and, 79–95
Resistance gene complexes
allelic diversity, 296–97
diversifying selection, 295–97
durable resistance, 300–2
interspecific transfer, 299–300
introduction, 286
in vitro construction, 302–3
multi-gene complexes, 298
mutation, 295–97
recombination, 292–95
selection, 295–97
transgenes, 298–302
types of *R* genes and *R* gene loci
chromosomal arrangement, 289–91
protein coding, 286–89
Resistance gene-like loci
potato resistance gene organization and, 92
Restriction enzyme-mediated integration (REMI)
fungal pathogenicity and, 347
Restriction fragment length polymorphisms (RFLPs)
Burkholderia cepacia complex diversity and, 231
potato resistance gene organization and, 82–83, 86, 88–90, 92–93
variability and genetic structure of plant virus populations, 171–75
Retroviruses
variability and genetic structure of plant virus populations, 162
Reverse genetics
fungal pathogenicity and, 348–50
RGC2 gene
resistance gene complexes and, 290
RGD peptides
surface attachment and pre-penetration biology of fungi, 391–93
R genes
apomictic polyphagous root-knot nematodes and, 53, 55, 61–63, 65
plant RNA virus capsid proteins and, 437–38
polygalacturonase-inhibiting proteins and defense against fungi, 329
potato resistance gene organization and, 79–95
predicting durability of, 187–216
resistance gene complexes and, 285–303
variability and genetic structure of plant virus populations, 170
Rhabdovirus spp.
plant RNA virus capsid proteins and, 433, 436
Rhizobium leguminosarum
leafy gall formation by *Rhodococcus fascians* and, 42
Rhizobium meliloti
leafy gall formation by *Rhodococcus fascians* and, 42
rhizosphere colonization by *Pseudomonas* and, 470
Rhizoctonia solani
biological control in greenhouse systems and, 108, 111
Burkholderia cepacia complex diversity and, 232–33
polygalacturonase-inhibiting proteins and defense against fungi, 318
Rhizoctonia spp.
biological control in

greenhouse systems and, 104–5, 109
turfgrass disease diagnosis and, 142, 145
Rhizopus sp.
polygalacturonase-inhibiting proteins and defense against fungi, 317
Rhizosphere
Burkholderia cepacia complex diversity and, 225, 227, 230–32
Rhizosphere colonization
by Pseudomonas
biocontrol, 476–77
biofilm formation, 477–78
cell surface polysaccharides, 470
chemotaxis, 467–68
colony phase variation, 473–75
competitive root tip colonization, 466–67, 475–76
exudate, 472–73, 478
flagella, 467–68
functional genomics, 480–81
future research, 481
gene and trait comparison, 478–79
gnotobiotic system, 463–65
improvement of colonization, 479–80
introduction, 462–63
lipopolysaccharide, 469
microcolonies, 477
motility, 467–68
mutants, 478
NADH dehydrogenases, 475–76
nutrition, 471–72
outer membrane permeability, 475
P. fluorescens QWCS364 interaction with putrescine, 472–73
pili, 468–69
promoters, 478
protein secretion, 473
prototrophy for vitamins and building blocks, 470–71
quorum sensing, 477
simultaneous imaging of dfferent populations of microbes, 465–66
site-specific recombination, 473–75
twitching motility, 468–69
Rhodococcus fascians
leafy gall formation and, 27–43
Rhynchosporium secalis
fungal pathogenicity and, 350
Ribonuclease protection assay
variability and genetic structure of plant virus populations, 171, 173
Rice
tropical plant pathology and, 5
Rice dwarf virus
plant RNA virus capsid proteins and, 433
Rice tungro bacilliform virus
variability and genetic structure of plant virus populations, 158, 174
Rice yellow mottle virus
variability and genetic structure of plant virus populations, 158, 168, 174
Rifampicin
predicting durability of *R* genes and, 209
RNA viruses
variability and genetic structure of plant virus populations, 160–63, 167, 169, 171
Rod-shaped RNA virus coat proteins
plant RNA virus capsid proteins and, 421–22
Root cyst nematodes
potato resistance gene organization and, 79, 83, 85–86
Root-knot nematodes
apomictic polyphagous, 53–70
Roots
apomictic polyphagous root-knot nematodes and, 66
biotrophic pathogens and, 53–70, 53
rhizosphere colonization by *Pseudomonas* and, 461–80
Rotelynchulus reniformis
apomictic polyphagous root-knot nematodes and, 54, 67
Rotifers
apomictic polyphagous root-knot nematodes and, 53, 60–61
Rp1 gene
resistance gene complexes and, 291–92
Rpg4 gene
predicting durability of *R* genes and, 206
Rpm1 gene
resistance gene complexes and, 289
rpoN gene
common mechanisms for pathogens and, 263, 267
Rpp5 gene
resistance gene complexes and, 291
rps genes

predicting durability of *R* genes and, 199
resistance gene complexes and, 288–89
Rrs1 gene
predicting durability of *R* genes and, 201, 206–7
Rsv gene
variability and genetic structure of plant virus populations, 170
RTM genes
plant RNA virus capsid proteins and, 427
Rusts
barley yellow rust and, 367–407
cereal diseases and, 15–18, 21–23
predicting durability of *R* genes and, 193
Rx genes
plant RNA virus capsid proteins and, 438
potato resistance gene organization and, 84–85, 87, 89
Ryegrass mosaic virus
variability and genetic structure of plant virus populations, 158, 165
Ry genes
potato resistance gene organization and, 85, 87, 95
Rynchosporium secalis
predicting durability of *R* genes and, 201, 206–7

S

Saccharomyces cerevisiae
fungal pathogenicity and, 338, 352–54
surface attachment and pre-penetration biology of fungi, 397
sad genes
rhizosphere colonization by *Pseudomonas* and, 477
Salicyclic acid
Burkholderia cepacia complex diversity and, 233, 238
Salmonella typhimurium
common mechanisms for pathogens and, 264, 271
rhizosphere colonization by *Pseudomonas* and, 479
Saprolegnia ferax
surface attachment and pre-penetration biology of fungi, 392
Saprophytes
fungal pathogenicity and, 337
Satellite RNA (sat-RNA)
variability and genetic structure of plant virus populations, 158, 160, 165, 169, 174–75
Satellite tobacco mosaic virus
variability and genetic structure of plant virus populations, 158, 160, 173
Satellite tobacco necrosis virus
variability and genetic structure of plant virus populations, 158
SC genes
surface attachment and pre-penetration biology of fungi, 393–94
Schizophyllum commune
surface attachment and pre-penetration biology of fungi, 393
Schizosaccharomyces pombe
fungal pathogenicity and, 341
Sclerotinia spp.
biological control in greenhouse systems and, 103, 107
polygalacturonase-inhibiting proteins and defense against fungi, 315, 317
turfgrass disease diagnosis and, 139, 142, 145
Sclerotium spp.
polygalacturonase-inhibiting proteins and defense against fungi, 315–16
turfgrass disease diagnosis and, 142, 145
secB operon
rhizosphere colonization by *Pseudomonas* and, 473
Second messengers
surface attachment and pre-penetration biology of fungi, 397–99
Selection
apomictic polyphagous root-knot nematodes and, 53, 62–63
barley yellow rust and, 373
marker-assisted
potato resistance gene organization and, 79, 94–95
leafy gall formation by *Rhodococcus fascians* and, 27
predicting durability of *R* genes and, 189, 191–93
resistance gene complexes and, 285, 295–98
variability and genetic structure of plant virus populations, 157, 163, 165–69
Semipersistent transmission
plant RNA virus capsid proteins and, 431
Sen1 gene
potato resistance gene

organization and, 85, 90
Senecio clivicola
apomictic polyphagous root-knot nematodes and, 66
Septoria spp.
fungal pathogenicity and, 341, 350, 353
Serenade®
biological control in greenhouse systems and, 111
Sesame spp.
apomictic polyphagous root-knot nematodes and, 66
Shigella flexneri
common mechanisms for pathogens and, 268, 273
Shoot amplification
leafy gall formation by *Rhodococcus fascians* and, 27–28, 30–31, 33
Shoot growth inhibition
leafy gall formation by *Rhodococcus fascians* and, 27, 30–31, 33, 40–42
Siderophores
Burkholderia cepacia complex diversity and, 233, 238
Sigma factor
common mechanisms for pathogens and, 267, 275
Signal transduction
apomictic polyphagous root-knot nematodes and, 68
leafy gall formation by *Rhodococcus fascians* and, 27
surface attachment and pre-penetration biology of fungi, 385, 388, 390, 392, 395, 397–407
Signature-tagged mutagenesis
fungal pathogenicity and, 348
Simple sequence repeats
potato resistance gene organization and, 83, 86
Single nucleotide polymorphisms (SNPs)
potato resistance gene organization and, 82
Single-stranded conformation polymorphisms (SSCPs)
variability and genetic structure of plant virus populations, 171, 174
sirA gene
common mechanisms for pathogens and, 264
Site-specific recombination
rhizosphere colonization by *Pseudomonas* and, 473–75
Smuts
cereal diseases and, 22
Sobemovirus spp
plant RNA virus capsid proteins and, 421
Soil-borne wheat mosaic virus
plant RNA virus capsid proteins and, 435
SoilGard®
biological control in greenhouse systems and, 108
Solanum spp.
apomictic polyphagous root-knot nematodes and, 66
potato resistance gene organization and, 86–89
tropical plant pathology and, 6
Sole virus-encoded determinant
plant RNA virus capsid proteins and, 430
Solvent-exposed residues
polygalacturonase-inhibiting proteins and defense against fungi, 313
Soybean mosaic virus
variability and genetic structure of plant virus populations, 158, 170
Soybeans
tropical plant pathology and, 3
Species hybridization
apomictic polyphagous root-knot nematodes and, 58–59
Specificity
polygalacturonase-inhibiting proteins and defense against fungi, 313, 329
Specificity domain
resistance gene complexes and, 288
Spinacia oleracea
plant RNA virus capsid proteins and, 427
Spongospora subterranea
plant RNA virus capsid proteins and, 434
potato resistance gene organization and, 87
Spores
apomictic polyphagous root-knot nematodes and, 62
cereal diseases and, 17–18
surface attachment and pre-penetration biology of fungi, 386–97
Sr genes
predicting durability of *R* genes and, 193, 212
sss gene
rhizosphere colonization by *Pseudomonas* and, 473–74, 479–80
"Stabilizing selection" concept

predicting durability of *R* genes and, 189, 191–93
Stagnospora nodorum
fungal pathogenicity and, 349
Stakman EC, 3–4, 10–11, 13, 23–24
Staphylococcus aureus
Burkholderia cepacia complex diversity and, 236
Stems
potato resistance gene organization and, 88
Stenotrophomonas maltophilia
Burkholderia cepacia complex diversity and, 246
Strain registration
Burkholderia cepacia complex diversity and, 225–48
ß-Strand-ß-turn motifs
polygalacturonase-inhibiting proteins and defense against fungi, 313
Streptomyces spp.
biological control in greenhouse systems and, 108–9
leafy gall formation by *Rhodococcus fascians* and, 36
tropical plant pathology and, 7
Stripe rust
barley yellow rust and, 367–407
Strobilurins
barley yellow rust and, 379
Burkholderia cepacia complex diversity and, 242
Stylet
apomictic polyphagous root-knot nematodes and, 56, 68
Subsistence agriculture
tropical plant pathology and, 9
Sugar cane
tropical plant pathology and, 5
Sunn-hemp mosaic virus
plant RNA virus capsid proteins and, 425
Suppression subtractive hybridization
fungal pathogenicity and, 351
Surface attachment
pre-penetration biology of fungi and, 385–407
Surface hardness
surface attachment and pre-penetration biology of fungi, 389–91
Sustainable agriculture
tropical plant pathology and, 1, 8
Sustainable management
barley yellow rust and, 367
"Swapping"
predicting durability of *R* genes and, 216
Sweet potato chlorotic stunt virus
variability and genetic structure of plant virus populations, 158, 174
Sweet potato feathery mottle virus
variability and genetic structure of plant virus populations, 158, 168, 174
Symbiosis
apomictic polyphagous root-knot nematodes and, 54, 69–70
Synchytrium endobioticum
potato resistance gene organization and, 81, 88
Synteny
potato resistance gene organization and, 83

T

Teboconazole
barley yellow rust and, 377
Telone
Burkholderia cepacia complex diversity and, 242
Thanatephorus cucumeris
tropical plant pathology and, 8
Theophiline
fungal pathogenicity and, 343
Thiabendazole
Burkholderia cepacia complex diversity and, 242
Thigmotropism
surface attachment and pre-penetration biology of fungi, 389–91
Thiophanate methyl
turfgrass disease diagnosis and, 145–46
Thiram
Burkholderia cepacia complex diversity and, 242
turfgrass disease diagnosis and, 145
THR1 gene
fungal pathogenicity and, 346
Thurston HD, 1–11
Tilt®
barley yellow rust and, 377
Tm-1 gene
variability and genetic structure of plant virus populations, 169
Tobacco etch virus
plant RNA virus capsid

proteins and, 425
Tobacco mild green mosaic virus
variability and genetic structure of plant virus populations, 158, 160, 164–65, 168–70, 173
Tobacco mosaic virus
plant RNA virus capsid proteins and, 423–24, 427
potato resistance gene organization and, 90
variability and genetic structure of plant virus populations, 158, 160–65, 168, 170
Tobacco rattle virus
plant RNA virus capsid proteins and, 433
Tobamovirus spp.
plant RNA virus capsid proteins and, 423–25, 437, 441, 444
Tobravirus spp.
plant RNA virus capsid proteins and, 433, 435
Tomato aspermy virus
variability and genetic structure of plant virus populations, 158, 170
Tomato bushy stunt virus
plant RNA virus capsid proteins and, 434
variability and genetic structure of plant virus populations, 158, 169
Tomato mosaic virus
variability and genetic structure of plant virus populations, 158, 169
Tomato spotted wilt virus
plant RNA virus capsid proteins and, 433
Tombusvirus spp.
plant RNA virus capsid proteins and, 426, 434
tom gene
Burkholderia cepacia complex diversity and, 235
Tospovirus spp.
resistance gene complexes and, 287
variability and genetic structure of plant virus populations, 169
toxA gene
common mechanisms for pathogens and, 263, 266–67, 270
Traditional farmers
tropical plant pathology and, 1, 4–5, 8–9
Transcriptional regulation
common mechanisms for pathogens and, 262–68
plant RNA virus capsid proteins and, 428
Transgressive segregation
potato resistance gene organization and, 94
Triadimefon
barley yellow rust and, 376, 378
turfgrass disease diagnosis and, 145
Triadimenol
barley yellow rust and, 376–78
Trichoderma spp.
biological control in greenhouse systems and, 103, 107–8, 111
Trichodex
biological control in greenhouse systems and, 111
Tricyclazole
fungal pathogenicity and, 343
Trifloxystrobin
turfgrass disease diagnosis and, 145
Tropical plant pathology
history of research, 1–11
Tsukumurella spp.
leafy gall formation by *Rhodococcus fascians* and, 29
Tuber crops
tropical plant pathology and, 1, 3, 6
Tuber soft rot
potato resistance gene organization and, 88
Turfgrass diseases
diagnosis of
air, 139
applied plant pathology, 151–52
biotechnology, 148–50
chemical imbalances, 139–41
diagnostic key, 141–44
diagnostic tools, 137–38
future research, 151
interview, 137
introduction, 135–36
light, 139
management groups, 144–48
new developments, 148–52
overview, 136–48
recommending management strategy, 147–48
sample, 138–39
speed, 137
stress factors, 137–47
summary, 152
taxonomy, 144–47
telecommunications, 150–51
water, 139
Turnip crinkle virus
plant RNA virus capsid proteins and, 424
Turnip mosaic virus
variability and genetic structure of plant virus

populations, 158, 169
Turnip vein-clearing virus
plant RNA virus capsid proteins and, 444
Turnip yellow mosaic virus
variability and genetic structure of plant virus populations, 158, 170–71
Twitching motility
rhizosphere colonization by *Pseudomonas* and, 468–69
Ty1 gene
potato resistance gene organization and, 90
Typhula spp.
turfgrass disease diagnosis and, 142, 145
tyrB gene
rhizosphere colonization by *Pseudomonas* and, 470, 471

U

uac1 gene
fungal pathogenicity and, 346
ubc genes
fungal pathogenicity and, 346
ukc1 gene
fungal pathogenicity and, 349
Ulocladium spp.
biological control in greenhouse systems and, 103, 110, 112
Umbravirus spp.
plant RNA virus capsid proteins and, 423, 426–27, 432
"Uncontrolled" nuclear division/growth
apomictic polyphagous root-knot nematodes and, 68
Undifferentiated population
variability and genetic structure of plant virus populations, 157
United States Department of Agriculture (USDA)
barley yellow rust and, 374, 378, 380
biological control in greenhouse systems and, 107–8
cereal diseases and, 20–23
"Universal" markers
potato resistance gene organization and, 95
Uredo glumarum
barley yellow rust and, 369
Uromyces appendiculatus
surface attachment and pre-penetration biology of fungi, 387, 390–93
Uromyces fabae
fungal pathogenicity and, 339, 350
Urtica diocia
apomictic polyphagous root-knot nematodes and, 66
Ustilago maydis
fungal pathogenicity and, 337, 341, 346–47, 349, 351, 353
surface attachment and pre-penetration biology of fungi, 407

V

Variability
apomictic polyphagous root-knot nematodes and, 62–64, 70
plant virus populations and, 157–77
Varicosavirus spp.
plant RNA virus capsid proteins and, 434
Vectors
plant RNA virus capsid proteins and, 419, 430–35
rhizosphere colonization by *Pseudomonas* and, 465
variability and genetic structure of plant virus populations, 157–77
"Vegetable pathology"
cereal diseases and, 20, 23
Ventura inequalis
polygalacturonase-inhibiting proteins and defense against fungi, 316
Verticillium spp.
tropical plant pathology and, 7
Vesicular stomatitis virus
plant RNA virus capsid proteins and, 436
variability and genetic structure of plant virus populations, 164
Vibrio cholerae
common mechanisms for pathogens and, 268
rhizosphere colonization by *Pseudomonas* and, 479
Vibrio fischeri
rhizosphere colonization by *Pseudomonas* and, 478–79
Vinclozolin
turfgrass disease diagnosis and, 145
Viral coat proteins
plant RNA virus capsid proteins and, 419–46
Viroids
variability and genetic structure of plant virus populations, 158, 165
virPphA gene
predicting durability of *R* genes and, 200, 203
Virulence genes
apomictic polyphagous root-knot nematodes and, 53, 62–63

barley yellow rust and, 371–73
Burkholderia cepacia complex diversity and, 237–38, 248
common mechanisms for pathogens and, 259, 273–74
leafy gall formation by *Rhodococcus fascians* and, 35–42
predicting durability of *R* genes and, 206–7
variability and genetic structure of plant virus populations, 165, 169
Vi ruses
multifunctional capsid proteins and, 419–46
plant virus populations and, 157–77
potato resistance gene organization and, 79–80, 86–87, 90, 94–95
predicting durability of *R* genes and, 205
tropical plant pathology and, 7, 10
Vitamins
rhizosphere colonization by *Pseudomonas* and, 470–71
Vitavax®
barley yellow rust and, 377
Vitis vinifera
polygalacturonase-inhibiting proteins and defense against fungi, 314

W

Walker JC, 10–11
wapQ gene
rhizosphere colonization by *Pseudomonas* and, 475
Wart fungus
potato resistance gene organization and, 88–89, 94
wbpN gene
rhizosphere colonization by *Pseudomonas* and, 470
Wheat
tropical plant pathology and, 5
Wheat streak mosaic virus
variability and genetic structure of plant virus populations, 158, 173
White clover mosaic virus
plant RNA virus capsid proteins and, 426
Witches' broom formation
leafy gall formation by *Rhodococcus fascians* and, 29–30
Woods AF, 23
Wound tumor virus
variability and genetic structure of plant virus populations, 158, 166, 170

X

Xa genes
predicting durability of *R* genes and, 190–91, 211–14
resistance gene complexes and, 289, 291
Xanthomonas axonopodis
predicting durability of *R* genes and, 216
Xanthomonas campestris
Burkholderia cepacia complex diversity and, 237
predicting durability of *R* genes and, 194–97, 202, 207–10, 215–16
turfgrass disease diagnosis and, 138
Xanthomonas citri
predicting durability of *R* genes and, 197, 202–3, 207–8
Xanthomonas oryzae
predicting durability of *R* genes and, 190–91, 197–98, 202, 207–8, 210–11, 213–14
Xanthomonas spp.
resistance gene complexes and, 287
xerC gene homologue
rhizosphere colonization by *Pseudomonas* and, 473
Xylocandins
Burkholderia cepacia complex diversity and, 233

Y

Yam mosaic virus
variability and genetic structure of plant virus populations, 158, 168–69, 174
Yeast
fungal pathogenicity and, 338, 352–54
Yersinia spp.
predicting durability of *R* genes and, 196

Z

Z-78
tropical plant pathology and, 3
Zeatin
leafy gall formation by *Rhodococcus fascians* and, 39
Zucchini yellow mosaic virus
variability and genetic structure of plant virus populations, 158, 164